

FORM PTO-1390  
(Rev 5-93)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

**NITROS P158US**

**TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371**

U.S. APPLICATION NO. (If known, use P.C. F.R.T.S.)  
**10/089652**

INTERNATIONAL APPLICATION NO.

**PCT/IB00/01400**

INTERNATIONAL FILING DATE

**October 2, 2000**

PRIORITY DATE CLAIMED

**October 1, 1999**

TITLE OF INVENTION

**LITHOTRIPTER APPARATUS**

APPLICANT(S) FOR DO/EO/US

**Patrick SANGOUARD**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☒ has been transmitted by the International Bureau. (PCT/IB/308 mailed **12 April 2001**).
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)) is attached.
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). (*unsigned*)
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98 with PTO FORM 1449.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.  
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification w/Marked-Up Version of Amended Specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
 

<input checked="" type="checkbox"/> Preliminary Examination Report <input checked="" type="checkbox"/> Annexes to Pre. Ex. Rep. <input type="checkbox"/> International Search Report <input type="checkbox"/> German Novelty Search Report ✓ <input type="checkbox"/> ___ copies of citations <input checked="" type="checkbox"/> Form PCT/IB/308 <input checked="" type="checkbox"/> International Publ. No. <b>WO 01/24712 A1</b> (Face page only)	<input checked="" type="checkbox"/> Copy of Request <input checked="" type="checkbox"/> Submission of Formal Drawings <input checked="" type="checkbox"/> <u>4</u> sheets of formal drawings <input checked="" type="checkbox"/> Abstract <input type="checkbox"/> Applicant Claims Small Entity Status <input type="checkbox"/> Copy of Notification of File Missing Parts <input checked="" type="checkbox"/> French Language Specification
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**CERTIFICATION UNDER 37 CFR 1.10**

I hereby certify that this Transmittal Letter and the papers indicated as being transmitted therewith is being deposited with the United States Postal Service on this date **April 1, 2002** in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number **EL 918840107 US** addressed to the: Box PCT, Assistant Commissioner of Patents, Washington, D.C. 20231.

**Michael J. Bujold**

(typed or printed name of person mailing paper)

(signature of person mailing paper)

PATENT & TRADEMARK OFFICE



020210

## 17. ■ The following fees are submitted:

**Basic National Fee (37 CFR 1.492(a)(5):**

Search Report has been prepared by the EPO or JPO ..... \$890.00

International preliminary examination fee paid to USPTO (37 CFR 1.492)(a)(1) .. \$710.00

No international preliminary examination fee paid to USPTO (37 CFR 1.492)(a)(2)  
but international search fee paid to USPTO (37 CFR 1.445(a)(2)). ..... \$740.00

Neither international preliminary examination fee (37 CFR 1.492)(a)(3)  
nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$1040.00

International preliminary examination fee paid to USPTO (37 CFR 1.492)(a)(4)  
and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =

CALCULATIONS

PTO USE ONLY

890

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months  
from the earliest claimed priority date (37 CFR 1.492(e)).

0

Claims	Number Filed	Number Extra	Rate
Total Claims	8 - 20 =	0	x \$18.00
Independent Claims	1 - 3 =	0	x \$84.00
Multiple dependent claim(s) (if applicable)			+ \$280.00

0

0

0

TOTAL OF ABOVE CALCULATIONS =

890

Reduction by ½ for filing by small entity, if applicable. **Applicant Claims Small Entity Status.** (Note 37 CFR 1.9, 1.27, 1.28).

0

SUBTOTAL =

890

Processing fee of \$130.00 for furnishing the English translation later the ☐ 20 ☐ 30 months  
from the earliest claimed priority date (37 CFR 1.492(f)).

0

TOTAL NATIONAL FEE =

0

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be  
accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property

0

TOTAL FEES ENCLOSED =

890

Amount to be:  
refunded

\$

charged

\$

a. ■ A check in the amount of \$ 890.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. 04-0213 in the amount of \$        to cover the above fees.  
A duplicate copy of this sheet is enclosed.

c. ■ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to  
Deposit Account No. 04-0213. A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

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PATENT &amp; TRADEMARK OFFICE



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2002 APR 01 10 08 52

10/089652

JC10 Rec'd PCT/PTO 01 APR 2002

PATENT APPLICATION

04/1/02

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of : Patrick SANGOUARD  
Serial no. :  
For : LITHOTRIPTER APPARATUS  
Docket : NITROS P158US

**BOX PCT**

The Commissioner of Patents and Trademarks  
Washington, D.C. 20231

**FIRST PRELIMINARY AMENDMENT**

Dear Sir:

By way of preliminary amendment, please amend the above identified application as set forth below.

**In the Specification:**

Please cancel paragraphs 2, 4, 11, 20 and 26 of the specification, in their entirety, in favor of a clean form of paragraphs 2, 4, 11, 20 and 26 of the specification, without any markings thereon, as follows. Accompanying this response is a copy of the original paragraphs of the specification which show the additions (by underlining and bold) and the deletions (by strikeout) to the canceled specification paragraphs. Please enter the replacement specification paragraphs into the record of this case.

**In the Claims:**

Please cancel claims 1-8, without prejudice or disclaimer of the subject matter therein, in favor of new claims 9-16 as follows.



9. (NEW) A lithotripter apparatus comprising a frame (11), a treatment table (12) for supporting a patient during the process of fragmenting a lithiasis (35), a device for generating shock waves by means of an electrical arc, a means for focusing these shock waves on said lithiasis, and a device (60) for live viewing of the treatment zone, said device for generating shock waves comprising a first electrode (33) and a second electrode (34) separated from each other and connected to a high voltage energy generating circuit, and the means for focusing these shock waves comprising a semi-ellipsoidal reflector (17), an extremity (33a) of the first electrode (33) and an extremity (34a) of the second electrode (34) being located essentially at a first focal point ( $F_e$ ) of the reflector (17), a second focal point ( $F_r$ ) of the reflector being centered on said lithiasis, said electrodes being equipped with a means of wear compensation, characterized in that said means for wear compensation on the electrodes (33, 34) comprises at least one compensation mechanism which axially displaces the first and second electrodes, independently of each other, along an axis corresponding to an axis of symmetry of the reflector (17) and turns at least one of said electrodes on its longitudinal axis.

10. (NEW) The apparatus according to claim 9, wherein the first electrode is located along the axis of the reflector (17) and housed inside a tube (41) which is joined to a first mechanism designed to axially displace said tube along with the first electrode it contains and to cause said tube to rotate along its longitudinal axis.

11. (NEW) The apparatus according to claim 9, wherein the second electrode (34) comprises a first and second portion (44, 45) connected to each other by a small bar (46), a first portion being located along the axis of the reflector (17) and the second portion (45) being housed inside a tube (47) which is connected to a second mechanism designed to axially displace said tube along with the electrode it contains.

12. (NEW) The apparatus according to claim 9, further comprising a computer designed to determine the spatial coordinates of the lithiasis to be treated (35) and of the reflector (17), a means for emitting control signals as a function of the values determined for said spatial coordinates, and a means for displacing said reflector as a function of said signals so as to position the receptor focal point ( $F_r$ ) on said lithiasis.

13. (NEW) The apparatus according to claim 12, wherein the means for displacing the reflector (17) comprises a housing (40) that holds a basin constituting the

reflector, a chariot to which the housing is attached, a plurality of essentially horizontal slides that are crossed allowing the chariot to be displaced in two orthogonal directions, a plurality of essentially vertical slides allowing it to be displaced in a third direction perpendicular to the two other directions, as well as one or more devices activating the chariot in these three directions.

14. (NEW) The apparatus according to claim 9, wherein the device for live viewing of the treatment zone includes a radioscopic apparatus comprising an x-ray generator (62) and an x-ray receiver (63), respectively attached to a first and second extremity of an arc-shaped arm (61) pivoting in its plane about its center, a scree (18) for displaying the radioscopic images, and a means for communicating the visual data to a computer in order to determine the relative coordinates of the emitting first focal point ( $F_e$ ) and of the lithiasis.

15. (NEW) The apparatus according to claim 9, wherein the live viewing device (60) comprises an echograph device as well as a plurality of cameras which are offset from each other, a screen for displaying the echograph images and a means for communicating the visual data to said computer in order to determine the relative coordinates of the emitting first focal point ( $F_e$ ) and of the lithiasis.

16. (NEW) The apparatus according to claim 15, wherein a first camera is located at the base of the apparatus, below the treatment zone, in order to furnish an image essentially perpendicular to said zone, and a second camera is offset to the side in order to furnish an image oblique to said zone.

01 12221 12222 12223 12224 12225 12226 12227 12228 12229 12230 12231 12232 12233 12234 12235 12236 12237 12238 12239 12240 12241 12242 12243 12244 12245 12246 12247 12248 12249 12250 12251 12252 12253 12254 12255 12256 12257 12258 12259 12260 12261 12262 12263 12264 12265 12266 12267 12268 12269 12270 12271 12272 12273 12274 12275 12276 12277 12278 12279 12280 12281 12282 12283 12284 12285 12286 12287 12288 12289 12290 12291 12292 12293 12294 12295 12296 12297 12298 12299 12300 12301 12302 12303 12304 12305 12306 12307 12308 12309 12310 12311 12312 12313 12314 12315 12316 12317 12318 12319 12320 12321 12322 12323 12324 12325 12326 12327 12328 12329 12330 12331 12332 12333 12334 12335 12336 12337 12338 12339 12340 12341 12342 12343 12344 12345 12346 12347 12348 12349 12350 12351 12352 12353 12354 12355 12356 12357 12358 12359 12360 12361 12362 12363 12364 12365 12366 12367 12368 12369 12370 12371 12372 12373 12374 12375 12376 12377 12378 12379 12380 12381 12382 12383 12384 12385 12386 12387 12388 12389 12390 12391 12392 12393 12394 12395 12396 12397 12398 12399 12400 12401 12402 12403 12404 12405 12406 12407 12408 12409 12410 12411 12412 12413 12414 12415 12416 12417 12418 12419 12420 12421 12422 12423 12424 12425 12426 12427 12428 12429 12430 12431 12432 12433 12434 12435 12436 12437 12438 12439 12440 12441 12442 12443 12444 12445 12446 12447 12448 12449 12450 12451 12452 12453 12454 12455 12456 12457 12458 12459 12460 12461 12462 12463 12464 12465 12466 12467 12468 12469 12470 12471 12472 12473 12474 12475 12476 12477 12478 12479 12480 12481 12482 12483 12484 12485 12486 12487 12488 12489 12490 12491 12492 12493 12494 12495 12496 12497 12498 12499 12500 12501 12502 12503 12504 12505 12506 12507 12508 12509 12510 12511 12512 12513 12514 12515 12516 12517 12518 12519 12520 12521 12522 12523 12524 12525 12526 12527 12528 12529 12530 12531 12532 12533 12534 12535 12536 12537 12538 12539 12540 12541 12542 12543 12544 12545 12546 12547 12548 12549 12550 12551 12552 12553 12554 12555 12556 12557 12558 12559 12560 12561 12562 12563 12564 12565 12566 12567 12568 12569 12570 12571 12572 12573 12574 12575 12576 12577 12578 12579 12580 12581 12582 12583 12584 12585 12586 12587 12588 12589 12590 12591 12592 12593 12594 12595 12596 12597 12598 12599 12600 12601 12602 12603 12604 12605 12606 12607 12608 12609 12610 12611 12612 12613 12614 12615 12616 12617 12618 12619 12620 12621 12622 12623 12624 12625 12626 12627 12628 12629 12630 12631 12632 12633 12634 12635 12636 12637 12638 12639 12640 12641 12642 12643 12644 12645 12646 12647 12648 12649 12650 12651 12652 12653 12654 12655 12656 12657 12658 12659 12660 12661 12662 12663 12664 12665 12666 12667 12668 12669 12670 12671 12672 12673 12674 12675 12676 12677 12678 12679 12680 12681 12682 12683 12684 12685 12686 12687 12688 12689 12690 12691 12692 12693 12694 12695 12696 12697 12698 12699 12700 12701 12702 12703 12704 12705 12706 12707 12708 12709 12710 12711 12712 12713 12714 12715 12716 12717 12718 12719 12720 12721 12722 12723 12724 12725 12726 12727 12728 12729 12730 12731 12732 12733 12734 12735 12736 12737 12738 12739 12740 12741 12742 12743 12744 12745 12746 12747 12748 12749 12750 12751 12752 12753 12754 12755 12756 12757 12758 12759 12760 12761 12762 12763 12764 12765 12766 12767 12768 12769 12770 12771 12772 12773 12774 12775 12776 12777 12778 12779 12780 12781 12782 12783 12784 12785 12786 12787 12788 12789 12790 12791 12792 12793 12794 12795 12796 12797 12798 12799 12800 12801 12802 12803 12804 12805 12806 12807 12808 12809 12810 12811 12812 12813 12814 12815 12816 12817 12818 12819 12820 12821 12822 12823 12824 12825 12826 12827 12828 12829 12830 12831 12832 12833 12834 12835 12836 12837 12838 12839 12840 12841 12842 12843 12844 12845 12846 12847 12848 12849 12850 12851 12852 12853 12854 12855 12856 12857 12858 12859 12860 12861 12862 12863 12864 12865 12866 12867 12868 12869 12870 12871 12872 12873 12874 12875 12876 12877 12878 12879 12880 12881 12882 12883 12884 12885 12886 12887 12888 12889 12890 12891 12892 12893 12894 12895 12896 12897 12898 12899 12900 12901 12902

Please consider new claims 9-16 upon consideration of this application.

Respectfully submitted,

  
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[001] LITHOTRIPTER APPARATUS

[002] ~~TECHNICAL DOMAIN~~ **FIELD OF THE INVENTION**

[003] The present invention concerns a lithotripter apparatus comprising a frame, a treatment table for supporting the patient during the procedure of fragmenting, a lithiasis, a device for generating shock waves using an electrical arc, a means for focusing said shock waves onto said lithiasis, and a device for viewing the procedure live, said shock wave generating device comprising two electrodes that are separated from each other and connected to a high voltage energy generator and the means for focusing said shock waves comprising a semi-ellipsoidal reflector, with the ends of said electrodes being located generally at one of the focal points of the reflector and the other focal point of said reflector being centered on said lithiasis, said electrodes being equipped with a means that compensates for wear.

[004] ~~PRIOR ART~~ **BACKGROUND OF THE INVENTION**

[005] A lithotripter is an apparatus designed to break up calcium kidney stones or lithiases, for example, using shock waves generated by an electric arc focused on points within the deposits inside the kidneys. The shock waves are generated by electrical arcs that are produced at one of the focal points, called the emission focal point, of a semi-ellipsoidal metal reflector which forms a basin. The basin is filled with salt water during the procedure and it is covered with a flexible, watertight membrane that is applied directly to the patient's skin to ensure a continuously conductive environment for the shock waves. The reflector is positioned so that the other focal point, called the receptor focal point, is located inside the lithiasis to be broken up or destroyed.

[006] The effectiveness of such a device and the reliability of the treatment depend primarily upon precisely positioning the receptor focal point on its target. To achieve this, two control means are necessary. One concerns the precise positioning of the electrodes which generate the electric arc relative to the emission focal point, and the other concerns the precise positioning of the receptor focal point relative to the lithiasis, which should be viewed live to allow precise positioning.





[014] In a particularly advantageous manner, one of the electrodes is located along the axis of the reflector and housed inside a tube that is joined to a first mechanism which axially displaces the tube and the electrode it holds and rotates the tube on its longitudinal axis. The other electrode comprises two portions connected to each other with a small bar, one of said portions being located along the axis of the reflector and the other portion being housed inside a tube that is connected to a second mechanism which axially displaces the tube along with the electrode it holds.

[020] SUMMARY **BRIEF DESCRIPTION OF THE DRAWINGS**

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[021] The present invention will be better understood with reference to the following description of a preferred embodiment of the lithotripter apparatus according to the invention and with reference to the drawings, provided by way of non-limiting examples, in which:

[022] Figure 1 shows a perspective view of the entire apparatus of the invention;

[023] Figure 2 is a schematic view showing the operating principles of the apparatus of the invention;

[024] Figure 3 is a schematic axial cross-section of the reflector and the electrodes of the lithotripter apparatus of the invention; and

[025] Figure 4 is a particular embodiment of the viewing device associated with the apparatus of the invention.

[026] METHOD(S) **DETAILED DESCRIPTION OF ACHIEVING THE INVENTION**

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[027] With reference to Figure 1, the lithotripter apparatus 10 as shown essentially comprises a frame 11 surmounted by a treatment table 12 which supports the patient to be treated. Frame 11 is in the form of a cabinet, with the right side 13 essentially containing the electrical and electronic equipment, the left side 14 essentially containing the mechanical equipment, and the center portion 15 principally containing a movable chariot 16 which holds a semi-ellipsoidal reflector 17 and a device which generates shock waves for dislocating the lithiases. A screen 18 held by an adjustable support 19 is attached to frame 11. A device for viewing of the treatment zone, one embodiment of which will be described with reference to Figure 4, is preferably independently associated with the device and with screen 18.

[028] Figure 2 is a schematic representation of reflector 17 surmounted by a membrane 31 and containing an acoustic transmitting liquid 32 which provides a continuous transmitting environment for the shock waves when the membrane is applied to the patient's body. The basin-shaped semi-ellipsoidal reflector 17 contains two electrodes 33 and 34, whose extremities 33a and 34a, located opposite each other, are positioned essentially axially relative to emission focal

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JC10 Rec'd PCT/PTO 01 APR 2002

03/29/02

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of : Patrick SANGOUARD  
Serial no. :  
For : LITHOTRIPTER APPARATUS  
Docket : NITROS P158US

**BOX PCT**

The Commissioner of Patents and Trademarks  
Washington, D.C. 20231

**SUBMISSION OF FORMAL DRAWINGS**

Enclosed please find four (4) sheets of formal drawings which are to be entered in this case.

In the event that there are any fee deficiencies or additional fees are payable, please charge the same or credit any overpayment to our Deposit Account (Account No. 04-0213).

Respectfully submitted,

  
Michael J. Bujold, Reg. No. 32,018  
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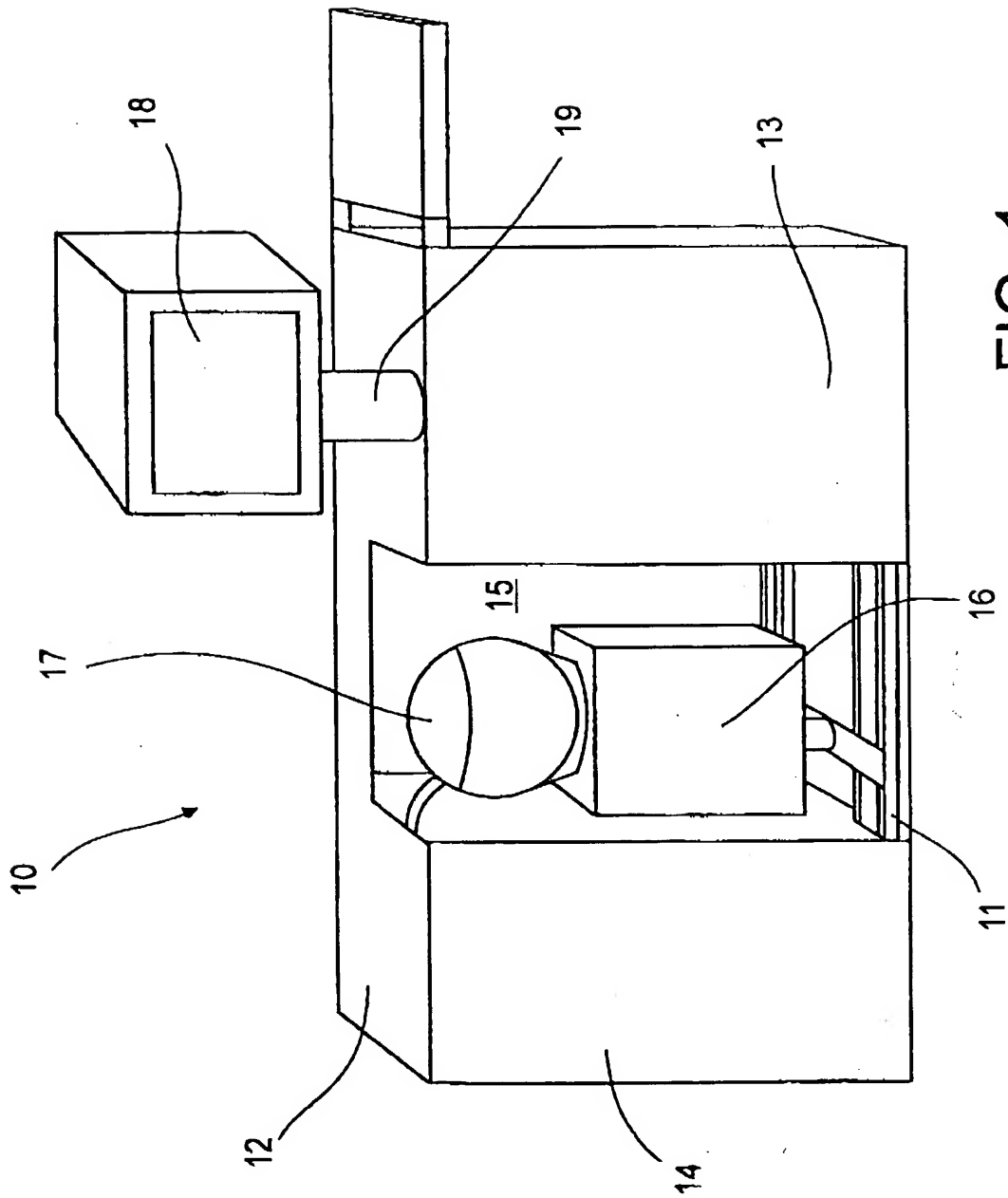


FIG. 1



3/4

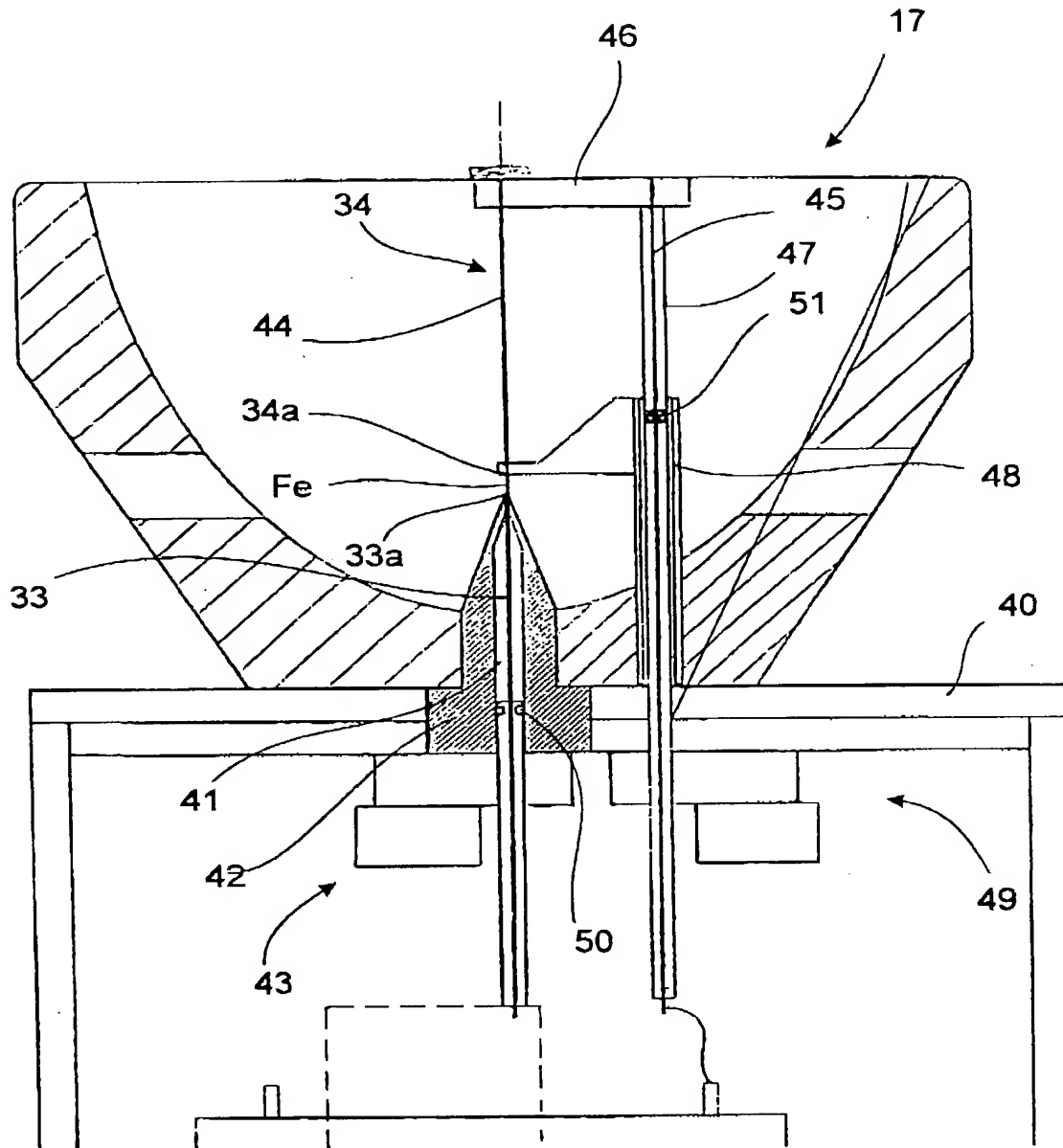


FIG. 3

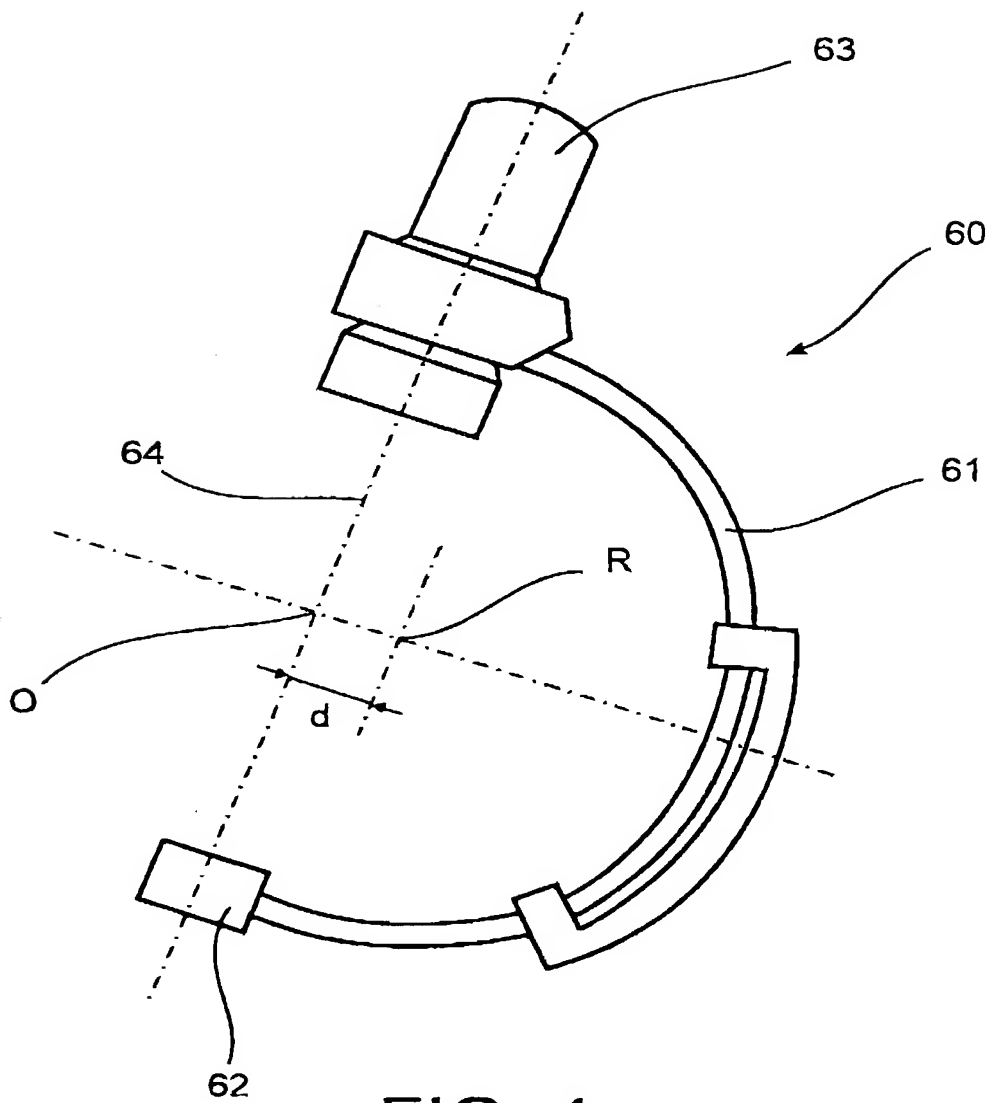


FIG. 4

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[001]

LITHOTRIPTER APPARATUS

[002]

TECHNICAL DOMAIN

[003]

The present invention concerns a lithotripter apparatus comprising a frame, a treatment table for supporting the patient during the procedure of fragmenting, a lithiasis, a device for generating shock waves using an electrical arc, a means for focusing said shock waves onto said lithiasis, and a device for viewing the procedure live, said shock wave generating device comprising two electrodes that are separated from each other and connected to a high voltage energy generator and the means for focusing said shock waves comprising a semi-ellipsoidal reflector, with the ends of said electrodes being located generally at one of the focal points of the reflector and the other focal point of said reflector being centered on said lithiasis, said electrodes being equipped with a means that compensates for wear.

[004]

PRIOR ART

[005]

A lithotripter is an apparatus designed to break up calcium kidney stones or lithiases, for example, using shock waves generated by an electric arc focused on points within the deposits inside the kidneys. The shock waves are generated by electrical arcs that are produced at one of the focal points, called the emission focal point, of a semi-ellipsoidal metal reflector which forms a basin. The basin is filled with salt water during the procedure and it is covered with a flexible, watertight membrane that is applied directly to the patient's skin to ensure a continuously conductive environment for the shock waves. The reflector is positioned so that the other focal point, called the receptor focal point, is located inside the lithiasis to be broken up or destroyed.

[006]

The effectiveness of such a device and the reliability of the treatment depend primarily upon precisely positioning the receptor focal point on its target. To achieve this, two control means are necessary. One concerns the precise positioning of the electrodes which generate the electric arc relative to the emission focal point, and the other concerns the precise positioning of the receptor focal point relative to the lithiasis, which should be viewed live to allow precise positioning.



[010] Certain other known devices have a means for moving the patient relative to the apparatus in order to move the lithiasis and the receptor focal point into coincidence or to move the receptor focal point, mechanically connected to the apparatus, into coincidence with the lithiasis. In both cases, the design is heavy and cumbersome. Furthermore, all the components, particularly the viewing devices, are dedicated devices, which increases cost considerably.

[011] EXPLANATION OF THE INVENTION

[012] The apparatus of the invention overcomes these various difficulties and provides an effective method of breaking up lithiases by applying shock waves which are perfectly adapted in strength and precisely aimed, thereby eliminating the possibility of causing lesions in surrounding tissue. This is due specifically to the fact that the system for compensating wear on the electrodes proposed by the invention eliminates diagonal wear on the electrodes that causes the shock wave generator to become off-center relative to the emission focal point on the reflector. Furthermore, this device is easily manageable in comparison with known devices, making the procedure simple, quick, and efficient, since its aim is very precise. Moreover, the auxiliary equipment such as the viewing devices are not dedicated devices, and they can be used for other purposes.

[013] This goal is achieved by the lithotripter apparatus of the invention, characterized in that said means for compensating wear on the electrodes comprises at least one compensation mechanism for axially displacing the two electrodes independently of each other along an axis corresponding to the axis of symmetry of the reflector and to cause at least one of said electrodes to turn on its longitudinal axis. Because of this, the extremities of the electrodes wear regularly and can always be positioned precisely so that the shock wave generator which they constitute is centered on the emission focal point of the reflector forming the basin, whatever the extent of wear on the electrodes. As a result of this, one of the basic conditions set forth above, i.e., that the shock waves be properly aimed at the lithiases to be treated, is fulfilled.

[014] In a particularly advantageous manner, one of the electrodes is located along the axis of the reflector and housed inside a tube that is joined to a first mechanism which axially displaces the tube and the electrode it holds and rotates the tube on its longitudinal axis. The other electrode comprises two portions connected to each other with a small bar, one of said portions being located along the axis of the reflector and the other portion being housed inside a tube that is connected to a second mechanism which axially displaces the tube along with the electrode it holds.

[015] The apparatus preferably includes a computer for determining the respective spatial coordinates of the lithiasis to be treated and of the reflector, a means for emitting control signals as a function of the values determined for said spatial coordinates, and a means for displacing said reflector as a function of said signals so that the receptor focal point is positioned on the lithiasis. This method of operation provides a high degree of precision in positioning the lithiasis and offers unparalleled flexibility in use.

[016] Advantageously, the means for displacing said reflector comprises a housing supporting the basin which constitutes the reflector, a chariot to which the housing is attached, some generally horizontal, crossed slides allowing the chariot to be displaced in two orthogonal directions, some generally vertical slides allowing it to be displaced in a third direction, perpendicular to the two other directions, as well as a means for activating the chariot in these three directions. For this reason, it is only necessary to move the shock wave generator, and there is no need to move either the patient or the entire apparatus.

[017] According to a first advantageous embodiment, the live viewing device has a radioscopic device comprising an x-ray generator and an x-ray receptor means which are respectively attached to the two ends of an arc-shaped arm pivoting in a plane about its center, a radioscopic image display screen, and a means for communicating the visual data to the computer in order to determine the relative coordinates of the emission focal point and of the lithiasis.

[018] According to a second embodiment, said live viewing device comprises an echograph apparatus as well as at least two cameras which are offset from each other, an echograph image display screen, and a means for communicating the visual data to the computer in order to determine the relative coordinates of the emission focal point and of the lithiasis.

[019] In this instance, one of the cameras is advantageously located at the base of the apparatus, below the treatment zone, in order to furnish an image that is generally perpendicular to said zone, and the other camera is offset to the side in order to furnish an image that is oblique to said zone.

[020] SUMMARY DESCRIPTION OF THE DRAWINGS

[021] The present invention will be better understood with reference to the following description of a preferred embodiment of the lithotripter apparatus according to the invention and with reference to the drawings, provided by way of non-limiting examples, in which:

[022] Figure 1 shows a perspective view of the entire apparatus of the invention;

[023] Figure 2 is a schematic view showing the operating principles of the apparatus of the invention;

[024] Figure 3 is a schematic axial cross-section of the reflector and the electrodes of the lithotripter apparatus of the invention; and

[025] Figure 4 is a particular embodiment of the viewing device associated with the apparatus of the invention.

[026] METHOD(S) OF ACHIEVING THE INVENTION

[027] With reference to Figure 1, the lithotripter apparatus 10 as shown essentially comprises a frame 11 surmounted by a treatment table 12 which supports the patient to be treated. Frame 11 is in the form of a cabinet, with the right side 13 essentially containing the electrical and electronic equipment, the left side 14 essentially containing the mechanical equipment, and the center portion 15 principally containing a movable chariot 16 which holds a semi-ellipsoidal reflector 17 and a device which generates shock waves for dislocating the lithiases. A screen 18 held by an adjustable support 19 is attached to frame 11. A device for viewing of the treatment zone, one embodiment of which will be described with reference to Figure 4, is preferably independently associated with the device and with screen 18.

[028] Figure 2 is a schematic representation of reflector 17 surmounted by a membrane 31 and containing an acoustic transmitting liquid 32 which provides a continuous transmitting environment for the shock waves when the membrane is applied to the patient's body. The basin-shaped semi-ellipsoidal reflector 17 contains two electrodes 33 and 34, whose extremities 33a and 34a, located opposite each other, are positioned essentially axially relative to emission focal



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[033] Figure 4 shows a portion of the apparatus that constitutes the means for live viewing 60 of the treatment zone. This device is preferably independent from the apparatus, but it can also be permanently attached to it. In the example shown, it consists of an arc-shaped radiosopic arm 61, called a C arm, holding an x-ray generator 62 on its lower extremity and an x-ray receiver means on its upper extremity, such as a light amplifier 63. The C arm is circular and it pivots in its plane about its pivot center R which is offset from axis 64 defined by generator 62 and amplifier 63. The offset  $d$  existing between R and the point of intersection O of axis 64 with the perpendicular axis passing through the pivot center R is of the order of 40-80 mm.

[034] In another embodiment, this x-ray viewing device can be replaced by an echograph lithiasis locator device which comprises, in a manner known in the art, an echograph sensor and a screen 18 which displays the capture images.

[035] During the procedure, two successive views are taken. One view is taken perpendicular to table 12 which supports the patient, and the other is taken obliquely to the table. The coordinates that are located and displayed on the screen are processed by a computer which precisely determines the coordinates of the shock wave generator. This procedure constitutes a calibration of the apparatus by means of triangulation. It is made possible by the fact that the C arm can pivot in its plane about its pivot center, which is located at the geometric center of the circular arc. After placing the patient on the operating table, the same procedure is followed to determine the position of the lithiasis. A first radioscope of the treatment zone is performed with the radiosopic arm in vertical position and a second radioscope of this zone is performed with the arm in oblique position, the angle being, for example, of the order of 20 degrees relative to the vertical. The coordinates of the lithiasis in the two images are introduced into the computer. It accurately determined the position of the shock wave generator so that emission focal point  $F_e$  can be positioned in such a way that receptor focal point  $F_r$ , corresponds to the lithiasis.

[036] A similar procedure can be performed by replacing the radiograph with an echograph. In this embodiment the apparatus comprises two respective cameras,

[037] After determining the coordinates, emission focal point  $F_e$  is placed in the proper position. For this purpose the apparatus has means for displacing reflector 17, or more specifically housing 40 that supports the basin forming the reflector, to the desired position. This means consists of a chariot to which said housing is attached, essentially horizontal, crossed slides for displacing the chariot in two orthogonal directions, essentially vertical slides for displacing it in a third direction perpendicular to the two other directions, as well as a means for activating the chariot in these three directions. The means is controlled by signals generated by the computer or by a signal generator associated with the computer and preferably transmitted to stepping motors connected to mechanical devices which displace the chariot.

## Claims

1. A lithotripter apparatus comprising a frame (11), a treatment table (12) for supporting a patient during the process of fragmenting the lithiasis (35), a device for generating shock waves by means of an electrical arc, a means for focusing these shock waves on said lithiasis, and a device (60) for live viewing of the treatment zone, said device for generating shock waves comprising two electrodes (33, 34) separated from each other and connected to a high voltage energy generating circuit, and the means for focusing these shock waves comprising a semi-ellipsoidal reflector (17), the extremities (33a, 34a) of said electrodes being located essentially at one ( $F_e$ ) of the focal points of the reflector (17), the other focal point ( $F_r$ ) of the reflector being centered on said lithiasis, said electrodes being equipped with a means of wear compensation, characterized in that said means for wear compensation on the electrodes (33, 34) comprises at least one compensation mechanism which axially displaces the two electrodes, independently of each other, along an axis corresponding to the axis of symmetry of the reflector (17) and turns at least one of said electrodes on its longitudinal axis.

2. An apparatus according to claim 1 characterized in that one (33) of the electrodes is located along the axis of the reflector (17) and housed inside a tube (41) which is joined to a first mechanism designed to axially displace said tube along with the electrode it contains and to cause said tube to rotate along its longitudinal axis.

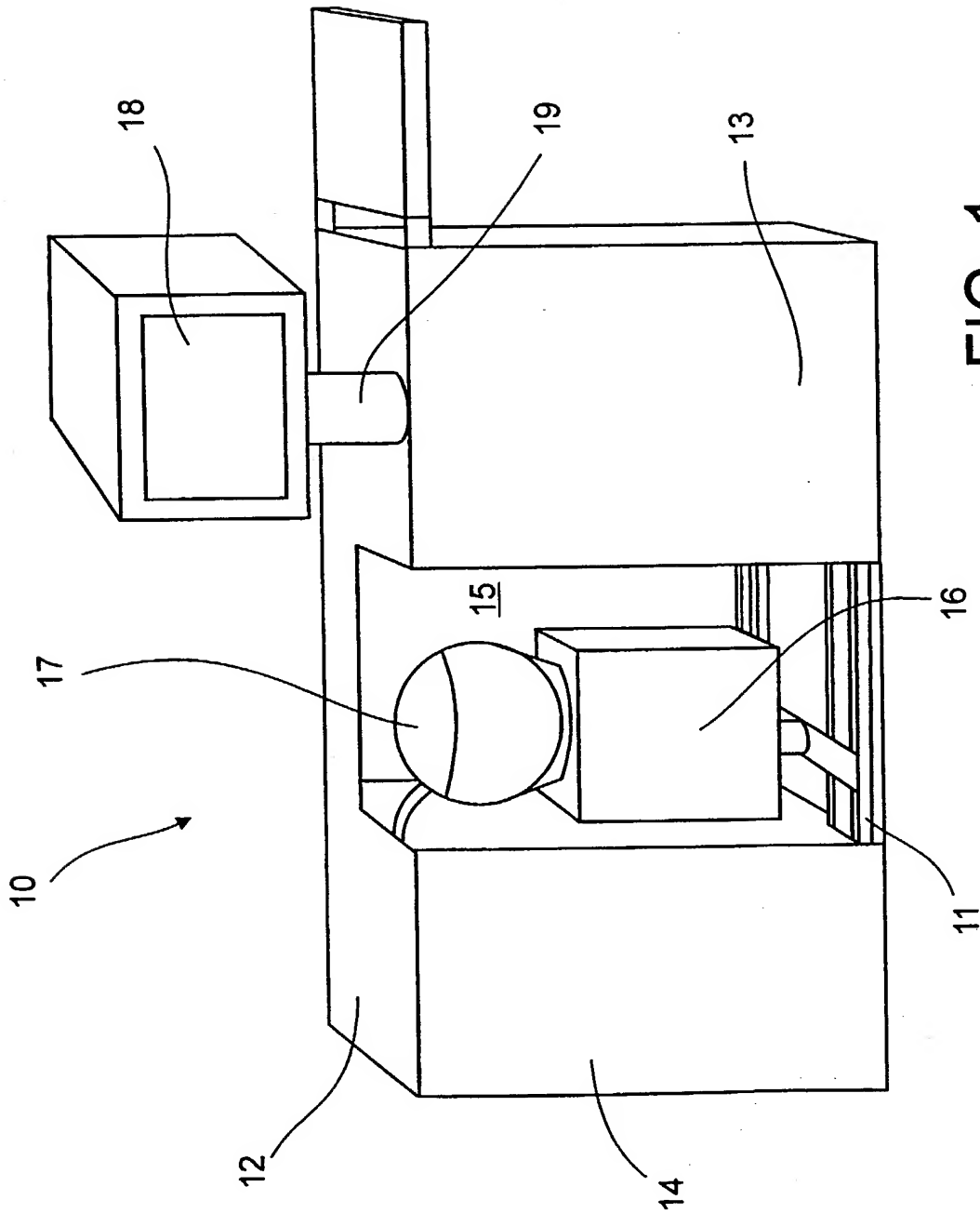
3. An apparatus according to claim 1 characterized in that the other electrode (34) comprises two portions (44, 45) connected to each other by a small bar (46), one (44) of said portions being located along the axis of the reflector (17) and the other portion (45) being housed inside a tube (47) which is connected to a second mechanism designed to axially displace said tube along with the electrode it contains.

4. An apparatus according to claim 1, characterized in that it comprises a computer designed to determine the spatial coordinates of the lithiasis to be treated (35) and of the reflector (17), a means for emitting control signals as a



8. An apparatus according to claim 7 characterized in that one of the cameras is located at the base of the apparatus, below the treatment zone, in order to furnish an image essentially perpendicular to said zone, and the other camera is offset to the side in order to furnish an image oblique to said zone.





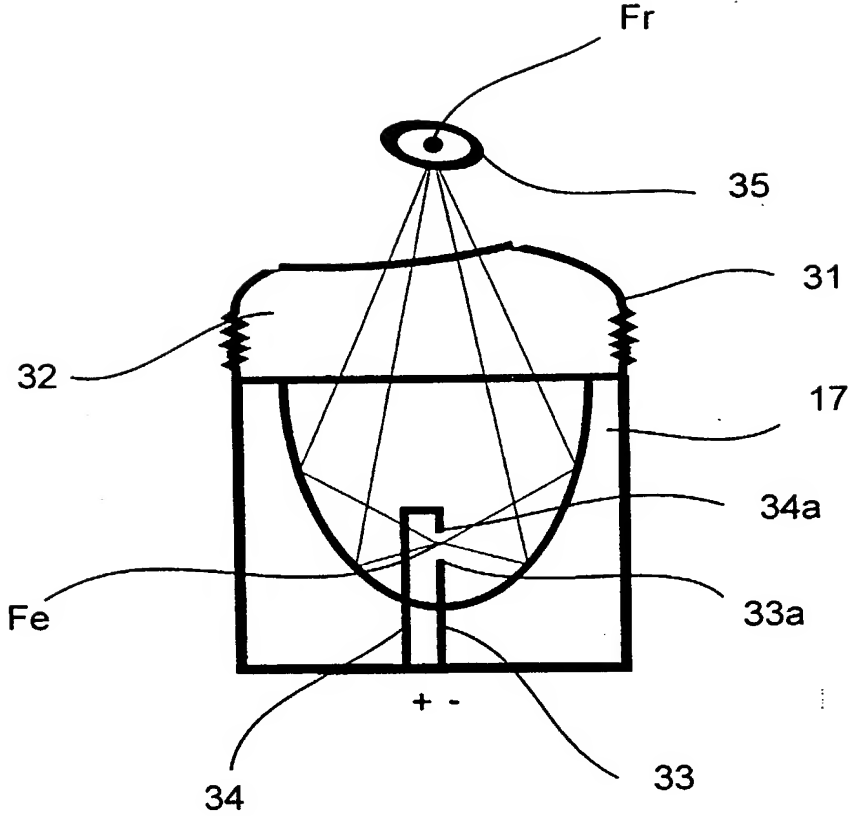


FIG. 2

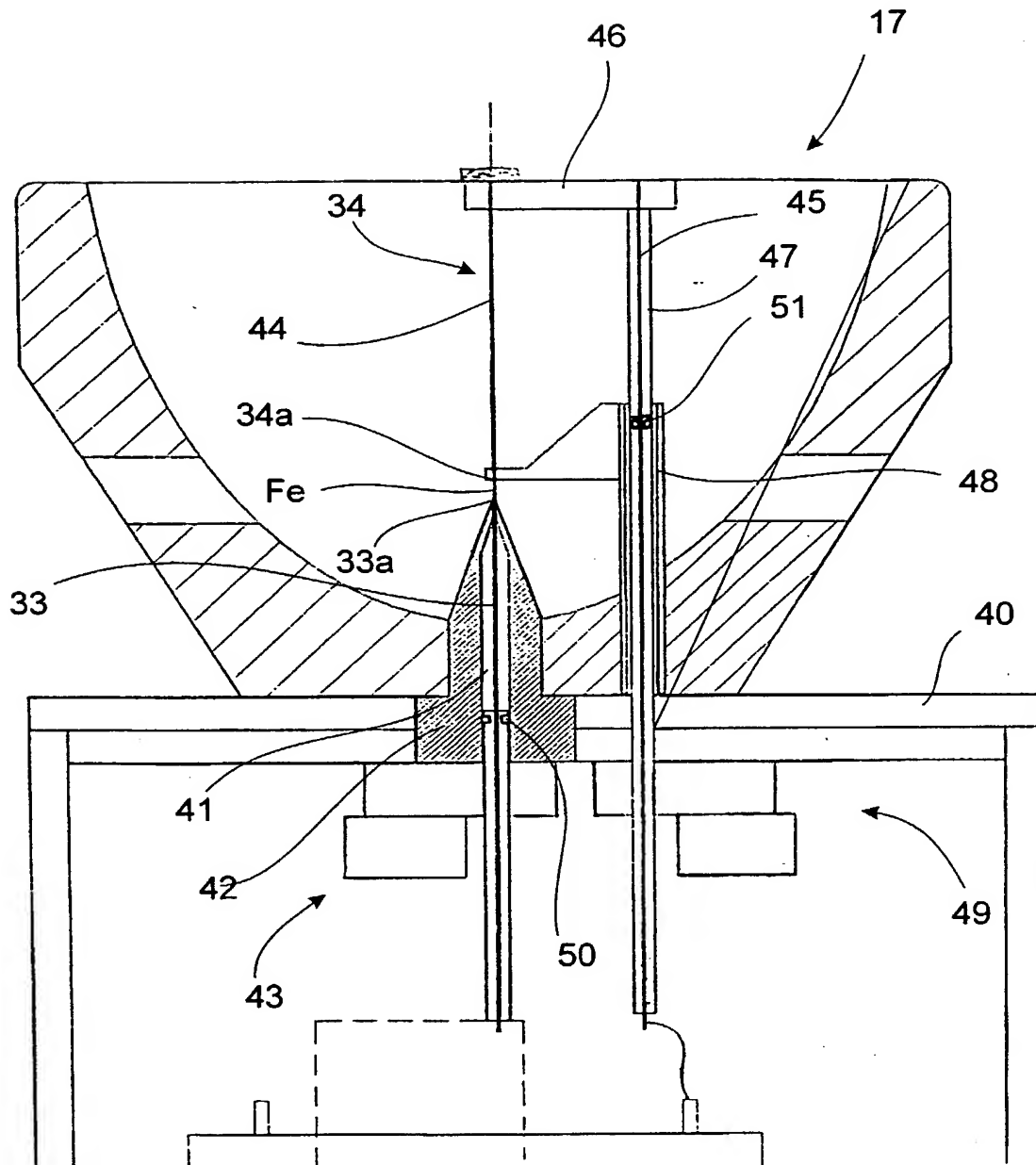


FIG. 3

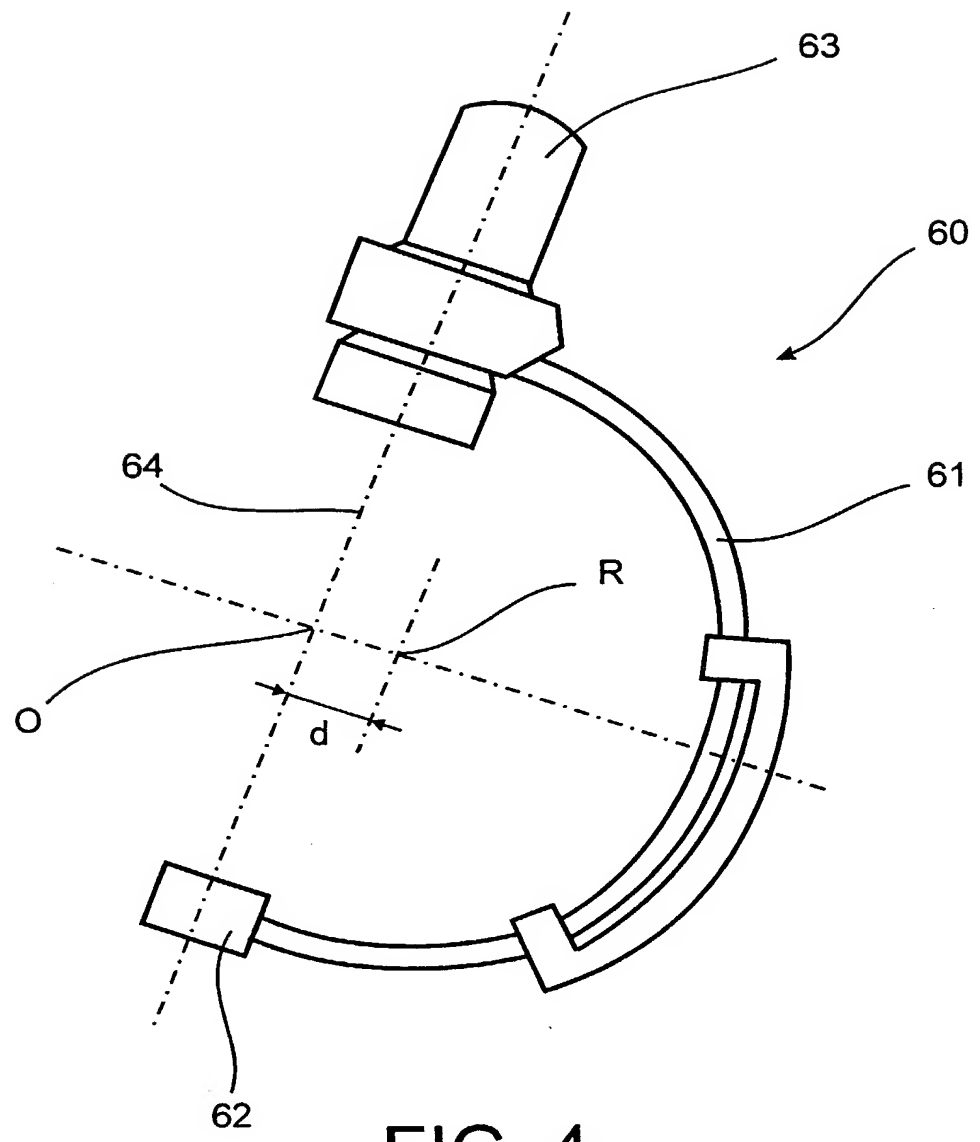


FIG. 4

NITROS P158US

**COMBINED DECLARATION AND POWER OF ATTORNEY**

(Original, Design, National Stage of PCT, Supplemental)

As a below named inventor, I hereby declare that:

**TYPE OF DECLARATION**

This declaration is of the following type: (check one applicable item below)

- ☐ original
- ☐ design
- ☐ supplemental
- ☒ National Stage of PCT
- ☐ divisional (see added page)
- ☐ continuation (see added page)
- ☐ continuation-in-part (see added page)

**INVENTORSHIP IDENTIFICATION**

My/our residence, post office address and citizenship is/are as stated below next to my/our name. I/We believe that the named inventor or inventors listed below is/are the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**TITLE OF INVENTION**

LITHOTRIPTER APPARATUS

**SPECIFICATION IDENTIFICATION**

The specification of which: (complete (a), (b) or (c))

- (a) ☐ is attached hereto.
- (b) ☐ was filed on \_\_\_\_\_ as  
☐ Serial No. \_\_\_\_\_ or  
☐ Express Mail No. \_\_\_\_\_ as Serial No. (not yet known) and  
was amended on \_\_\_\_\_ (if applicable).
- (c) ☒ was described and claimed in PCT International Application  
No. PCT/IB00/01400 filed on October 2, 2000 and as amended  
under PCT Article 19 on \_\_\_\_\_ (if any).
- (d) ☐ amended on \_\_\_\_\_

**POWER OF ATTORNEY**

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name(s) and registration number(s))

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Registration No. 32,018  
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3

☐ Attached as part of this Declaration and Power of Attorney is the authorization of the above-named attorney(s) to accept and follow instructions from my representative(s).

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[illegible]

I/We acknowledge the duty to disclose to the United States Patent Office all information which is known to be material to patentability of this application as defined in § 1.56 of Title 37 of the Code of Federal Regulations.

I/We hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me/us on the same subject matter having a filing date before that of the application(s) of which priority is claimed.


COUNTRY	APPLICATION NO.	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
FRANCE	99 12431	01 October 1999	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

☐ I/We hereby claim the benefit, under 35 U.S.C. 119(e), of any United States provisional application(s) listed below.

<u>Application Number(s)</u>	<u>Filing Date (MM/DD/YY)</u>	<input type="checkbox"/> Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.
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I/We hereby declare that all statements made herein of my/our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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FRX



**IMPORTANT NOTICE RE  
DUTY OF CANDOR AND GOOD FAITH**

The Duty of Disclosure requirements of Section 1.56(a), of Title 27 of the Code of Federal Regulations, are as follows:

A duty of candor and good faith toward the Patent and Trademark Office rests on the inventor, on each attorney or agent who prepares or prosecutes the application, and on every other individual who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application. All such individuals have a duty to disclose to the Patent Office all information they are aware of which is known to be material to patentability of the application. Such information is material where there is a substantial likelihood that a reasonable examiner would consider it important in deciding whether to allow the application to issue as a patent. The duty is commensurate with the degree of involvement in the preparation or prosecution of the application.

By virtue of this regulation, each inventor executing the Declaration for the filing of a patent application acknowledges his/her duty to disclose information of which he/she is aware and which may be material to the examination of the application.

Inherent in this is the duty to disclose any knowledge or belief that the invention:

- (a) was ever known or used in the United States of America before his/her invention thereof;
- (b) was patented or described in any printed publication in any country before his/her invention thereof or more than one year prior to the actual filing date of the United States patent application;
- (c) was in public use or on sale in the United States more than one (1) year prior to the actual filing date of the United States patent application; or
- (d) has been patented or made the subject of inventor's certificate issued before the actual filing date of the United States patent application in any country foreign to the United States on an application filed by him/her or his/her legal representative(s) or assign(s) more than twelve (12) months before the actual filing date in the United States.

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If there is any doubt concerning whether or not a citation is "material" to patentability of the application, it is better to err on the side of safety and disclose such art to the United States Patent Office.